

What is claimed is:

1. A swirl unit for a spray nozzle, wherein the spray
nozzle includes a carrier defining a spray aperture on one end
for emitting a spray, a first pair of locating surfaces formed on
approximately opposite sides of the carrier relative to each
other and axially spaced adjacent to the spray aperture for
receiving an orifice plate, and a second pair of locating
surfaces formed on approximately opposite sides of the carrier
relative to each other and formed on an opposite side of the
first pair of locating surfaces relative to the spray aperture
for receiving the swirl unit, wherein the swirl unit comprises:

a first end surface engageable with an orifice plate
received within the carrier adjacent to the first locating
surfaces; a second end surface axially spaced relative to the
first end surface; a peripheral surface formed between the first
and second end surfaces, wherein the peripheral surface defines
at least two locating surfaces formed on approximately opposite
sides of the swirl unit relative to each other and dimensioned
for slidably contacting the second locating surfaces of the
carrier upon inserting the swirl unit therein; at least one
recessed surface spaced radially inwardly from the at least two
locating surfaces of the swirl unit to thereby define a fluid
passageway between the swirl unit and carrier; and a swirl
chamber defined by an approximately curvilinear surface, and an
inlet port formed in fluid communication between the swirl
chamber and fluid passageway and defined at least in part by an

inlet surface formed between the curvilinear surface and the recessed surface.

2. A swirl unit as defined in claim 1, wherein the carrier further defines at least one retaining surface located on an opposite side of the second pair of locating surfaces relative to the first pair of locating surfaces and extending inwardly a predetermined distance for retaining the swirl unit within the carrier, and the at least one recessed surface of the swirl unit is spaced radially inwardly from the at least two locating surfaces of the swirl unit a distance greater than the predetermined distance defined by the at least one retaining surface of the carrier for clearing the retaining surface upon inserting the swirl unit into the carrier adjacent to the second locating surfaces.

3. A swirl unit as defined in claim 1, wherein the second pair of locating surfaces of the carrier are formed by a bore approximately defined by a first radius, and the peripheral surface is defined at least in part by a second radius selected for slidably contacting the second locating surfaces of the bore upon inserting the swirl unit therein.

4. A swirl unit as defined in claim 2, wherein the recessed surface is defined by an approximately planar surface formed on the peripheral surface.

5. A swirl unit as defined in claim 1, further defining a tapered surface formed between the peripheral and first end surfaces and tapering inwardly toward the first end surface for facilitating slidable movement of the swirl unit through the carrier.

6. A swirl unit as defined in claim 1, further comprising a tool-engaging surface formed on the second end surface and engageable with a tool for pressing the swirl unit toward the orifice plate and rotating the swirl unit and second end surface thereof into a position for engagement with the at least one retaining surface to thereby secure within the carrier the swirl unit and orifice plate.

7. A swirl unit as defined in claim 2, wherein the carrier defines at least two retaining surfaces spaced on approximately opposite sides of the carrier relative to each other, and each extending inwardly a predetermined distance for retaining the swirl unit within the carrier, and wherein the peripheral surface of the swirl unit defines at least two recessed surfaces on approximately opposite sides of the swirl unit relative to each other, and each recessed surface is spaced radially inwardly from the at least two locating surfaces of the swirl unit a distance greater than the predetermined distance defined by at least one respective retaining surface for clearing the retaining surfaces upon inserting the swirl unit into the carrier adjacent to the second locating surfaces.

8. A swirl unit as defined in claim 1, in further combination with an orifice plate defining a first end surface engageable with the carrier, a second end surface axially spaced relative to the first end surface and engageable with the first end surface of the swirl unit, a spray orifice formed through the orifice plate, and a peripheral surface formed between the first and second end surfaces and dimensioned for slidably contacting the first locating surfaces upon inserting the orifice plate into the carrier.

9. A swirl unit and orifice plate as defined in claim 8, wherein the orifice plate further defines a tapered surface at the juncture of the peripheral and first end surfaces for facilitating insertion of the orifice plate into the carrier adjacent to the first locating surfaces.

10. A swirl unit for a spray nozzle, wherein the spray nozzle includes a carrier defining a spray aperture on one end for emitting a spray, a first locating bore axially spaced adjacent to the spray aperture for receiving an orifice plate, and a second locating bore formed on an opposite side of the first locating bore relative to the spray aperture for receiving the swirl unit, wherein the swirl unit comprises:

a first end surface engageable with an orifice plate received within the first locating bore; a second end surface axially spaced relative to the first end surface; a peripheral

surface formed between the first and second end surfaces; first means for slidably contacting a surface forming the second locating bore upon inserting the swirl unit therein and aligning the swirl unit with the spray aperture; second means for receiving fluid through the swirl unit, and discharging fluid in a swirling pattern therefrom; and third means spaced radially inwardly relative to the first means for defining a fluid passageway between the swirl unit and carrier coupled in fluid communication with the second means to direct fluid into the second means and, in turn, discharge the fluid in a swirling pattern therefrom.

11. A swirl unit as defined in claim 10, wherein the carrier further defines at least one retaining surface located on an opposite side of the second locating bore relative to the first locating bore and extending inwardly a predetermined distance for retaining the swirl unit within the carrier, and the third means is defined by at least one recessed surface spaced radially inwardly a distance greater than the predetermined distance defined by the at least one retaining surface of the carrier for clearing the retaining surface upon insertion of the swirl unit into the carrier.

12. A swirl unit as defined in claim 10, wherein the first means is defined by at least two locating surfaces formed on approximately opposite sides of the peripheral surface relative to each other, and approximately defined by a radius for

slidably contacting the surface forming the second locating bore upon inserting the swirl unit therein.

13. A swirl unit as defined in claim 11, further comprising means for engaging a tool for pressing the swirl unit toward the orifice plate and rotating with the tool the swirl unit and second end surface thereof into a position for engagement with the at least one retaining surface to thereby secure within the carrier the swirl unit and orifice plate.

14. A spray nozzle, comprising:

a carrier defining a spray aperture on one end for emitting a spray, at least two first locating surfaces spaced on approximately opposite sides of the carrier relative to each other and axially spaced adjacent to the spray aperture for receiving an orifice plate, and at least two second locating surfaces spaced on approximately opposite sides of the carrier relative to each other and formed on an opposite side of the first locating surfaces relative to the spray aperture for receiving a swirl unit;

an orifice plate defining a first end surface engageable with the carrier, a second end surface axially spaced relative to the first end surface, a spray orifice formed through the orifice plate, and a peripheral surface formed between the first and second end surfaces and dimensioned for slidably contacting the first locating surfaces upon insertion of the orifice plate into the carrier; and

a swirl unit including a first end surface engageable with the orifice plate received within the carrier adjacent to the first locating surfaces, a second end surface axially spaced relative to the first end surface, a peripheral surface formed between the first and second end surfaces and defining at least two locating surfaces formed on approximately opposite sides of the swirl unit relative to each other and dimensioned for slidably contacting the second locating surfaces of the carrier upon insertion of the swirl unit therein, at least one recessed surface spaced radially inwardly from the at least two locating surfaces of the swirl unit to thereby define a fluid passageway between the swirl unit and carrier; a swirl chamber defined by at least one curvilinear surface formed within the swirl unit, and an inlet port formed in fluid communication between the swirl chamber and fluid passageway and defined at least in part by an inlet surface formed between the at least one curvilinear surface and the recessed surface.

15. A spray nozzle as defined in claim 14, wherein the carrier further defines at least one retaining surface located on an opposite side of the second locating surfaces relative to the first locating surfaces and extending inwardly a predetermined distance for retaining the swirl unit within the carrier, and wherein the at least one recessed surface is spaced radially inwardly from the at least two locating surfaces of the swirl unit a distance greater than the predetermined distance defined by the at least one retaining surface of the carrier for clearing

the retaining surface upon insertion of the swirl unit into the carrier, and the swirl unit further defines a tool-engaging surface formed on the second end surface and engageable with a tool for pressing the swirl unit toward the orifice plate and rotating the swirl unit and second end surface thereof into a position for engagement with the at least one retaining surface to thereby secure within the carrier the swirl unit and orifice plate

16. A spray nozzle as defined in claim 14, wherein the second locating surfaces of the carrier are formed by a locating bore approximately defined by a first radius, and the peripheral surface of the swirl unit is defined at least in part by a second radius selected for slidably contacting the second locating surfaces upon inserting the swirl unit into the bore.

17. A spray nozzle as defined in claim 16, wherein the recessed surface is defined by an approximately planar surface formed on the peripheral surface.

18. A spray nozzle as defined in claim 14, wherein the swirl unit further defines a tapered surface formed between the peripheral and first end surfaces and tapering inwardly toward the first end surface for facilitating slidable movement of the swirl unit within the carrier.

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